Neuroethology applications for HRI

Proposed supervision team: John Lones, Gabriella Lakatos, Patrick Holthaus

As we seek to introduce robots into people's everyday lives, one key challenge that remains is the notion of trust and affinity toward these robotic systems and how that will affect our acceptance of them. In particular, when we look at service-based robots, for example, robots that guide people in public spaces, to be truly accepted, do the users—ourselves—need to trust these systems, and, if so, how can we generate this trust? Studies have previously established that the perception of trust may be linked to our ability to perceive agency, the capacity to act or behave as a creature with its own wants or desires. This agency could be expressed through behaviours, emotions, or other means. However, such agency must be reflective and appropriate given both the robot, its current condition, and its environment, or it risks invoking a sense of the uncanny.

For this PhD, the proposed work will explore how ethologically-inspired systems can create life-like agency. Initial work has focused on exploring the underlying neuromodulation principles and triggers of emotion and behaviour, rather than implementing these emotions as static states. The work so far has focused on creating appropriate modelling of the neuromodulatory system, which regulates the release of various hormones and neurochemicals. The concentrations of these, and the subsequent "hormone soup," regulate the generation of emotions. The work has initially shown that by accurately modelling these elements, we can create a model which responds in a similar manner to its domestic counterpart and has shown to increase trust and bonding from human users. Models and the resulting system behaviours will be evaluated in human-robot interaction experiments with regard to their effectiveness in increasing perceived agency and trustworthiness of the robot.

The purpose of this work is twofold. Firstly, as we move into a robotic future in which we envision autonomous systems becoming an increasing part of both our home and general society, we seek to explore how these mechanisms can lead to the creation of bonds and trust within a robot, increasing the application of Human-Robot-Interaction, particularly in relation to the application of service robotics. Secondly, due to the proposed modelling approach—trying to replicate key features in an appropriate manner—we create a platform we can use to explore the role and emergence of features such as emotions and the roles that neuro-hormones may play, potentially giving insight into not only our own development but various areas of cognitive development. In addition, using an interdisciplinary approach and applying ethological models further contributes to the successful development of socially acceptable and credible interactive robots, contributing to the perception of agency and in turn, potentially trust in HRIs.

Person specifics

A good first degree in Robotics, Computer-science, Maths or a related Engineering topic and/or preferable a MSc degree in a related Field,

Proficiency in C++ or Python programming language.

Excellent communication skills in English, spoken and written.

The study itself is envisioned to be focused on real robotic systems such as the UniTree go2 and subsequently familiarity with robotic hardware is highly desirable.

Familiarity with ROS and Gazebo is desirable but not essential.

Contact Details for further discussion

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